Meal Replacement Mass Reduction and Integration Acceptability Study

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Abstract

NASA, in planning for long duration missions, has an imperative to provide a food system with the necessary nutrition, acceptability, and safety to ensure sustainment of crew health and performance. The Orion Multi-Purpose Crew Vehicle (MPCV) and future exploration missions are mass constrained; therefore we are challenged to reduce the mass of the food system by 10% while maintaining safety, nutrition, and acceptability for exploration missions. Food bars have previously been used to supplement meals in the Skylab food system, indicating that regular consumption of bars will be acceptable. However, commercially available products do not meet the requirements for a full meal replacement in the spaceflight food system. The purpose of this task is to develop a variety of nutritionally balanced breakfast replacement bars, which meet spaceflight nutritional, microbiological, sensorial, and shelf-life requirements, while enabling a 10% food mass savings. To date, six nutrient-dense meal replacement bars have been developed, using both traditional methods of compression as well as novel ultrasonic compression technologies developed by Creative Resonance Inc. (Phoenix, AZ). All bars will be prioritized based on acceptability and the four top candidates will be evaluated in the Human Exploration Research Analog (HERA) to assess the frequency with which actual meal replacement options may be implemented. Specifically, overall impact to mood, satiety, dietary discomfort, and satisfaction with food will be analyzed to inform successful implementation strategies. In addition, these bars will be evaluated based on final product sensory acceptability, nutritional stability, qualitative stability of analytical measurements (i.e. water activity and texture), and microbiological compliance over two years of storage at room temperature and potential temperature abuse conditions to predict long-term acceptability. It is expected that this work will enable a successful meal replacement strategy to be implemented that maintains crew food consumption and health, while informing exploration missions with appropriate mass savings expectations.